

REMARKS

Claims 1-36 are pending in the application.

Claims 1-36 stand rejected.

Claim 1 has been amended.

Applicants express heartfelt appreciation for the Examiner's withdrawal of the previous rejections under 35 U.S.C. § 112 and the previous claim objections.

Claim Objections

The Examiner has objected to claim 1 because of an antecedent basis error. Claim 1 has been amended to correct this informality by replacing the phrase "an upper-level system" with the phrase "said upper-level system." Thus, Applicants respectfully request that the objection to claim 1 be withdrawn.

Regarding the remarks beginning at page 11 of the February 15, 2006 Final Office Action that pertain to Applicants' January 13, 2006 Response to Non-Final Office Action, Applicants respectfully disagree and have addressed the reasons for this position at appropriate locations within the following remarks concerning the 102 and 103 rejections of the Final Office Action.

Rejection of Claims under 35 U.S.C. § 102

Claims 1 and 3-36 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Kashima et al, U.S. Patent No. 5,485,598 ("Kashima"). Applicants respectfully traverse this rejection for the following reasons.

As generally required by independent claims 14, 27, 30, and 33, independent claim 36 recites the following:

A method comprising:
maintaining a first cache and a second cache, wherein said maintaining is performed by one of an upper-level system and a lower-level system;
cloning information stored in a first unit of storage into a second unit of storage prior to modifying said information stored in said first unit of storage, wherein said first cache comprises said first unit of storage and said second cache comprises said second unit of storage; and
providing access to said second cache by the other of said upper-level system and said lower-level system.

In an attempt to demonstrate the limitations of Applicants' independent claim 36, on page 3 of the February 15, 2006 Final Office Action, Kashima's old data cache 17 is equated with Applicants' claimed "second cache." The Final Office Action then proceeds to depict Kashima's "main memory 12" as an upper-level system that performs the claimed maintaining of a second cache. In other words, to anticipate Applicants' claimed limitation, the Examiner is stating that Kashima's main memory 12 is configured to maintain the old data cache 17.

Regardless of whether Kashima actually shows something equivalent to main memory 12 being configured to maintain the old data cache 17, as would be required to meet Applicants' claimed limitation, to anticipate Applicants' claim 36 with the above associations, Kashima must also show a lower-level system that is provided access to Kashima's old data cache 17. Continuing along the same line of logic with the same paragraph on page 3 of the Final Office Action, Kashima's "CPU 11" is delineated as the lower-level system of Applicants' claims. However, Applicants respectfully submit that Kashima's CPU 11 is merely a different portion of what would be Kashima's upper-level system – not any sort of lower-level system at all.

At most, Kashima's CPU 11 can output "a data readout command" (Kashima, col. 3, lines 59-60) that reads out data, and even then, it is a stretch to say that data may at one time have been part of some sort of lower level system. Specifically, as part of the posited upper level

system operations to transfer a disk block from disk cache 13 to user buffer 14 (both of main memory 12; see Kashima, col. 4, lines 1-4 and Fig. 4), Kashima's CPU 11 must defer to disk array 1 (which would have to be correlated to a lower level system (by no means an intuitive nor mandatory correlation); see Fig. 1) to have a disk block retrieved from disk unit 2a if the data block is not already available in the disk cache 13 (see Kashima, col. 3, lines 62-66). As demonstrated at process block S3 of Kashima's Fig. 6, Kashima's CPU 11 is prevented from operating as anything even remotely comparable to a lower level system because, prior to CPU 11 transferring the data block to user buffer 14, "disk array reads data block out of disk to transfer it to disk cache." Thus, the elements of Kashima that the Office Action has associated with Applicants' claim terms, even if such an association could be properly made, would not operate as claimed by Applicants. In other words, Kashima would require the lower level system operation of moving a data block from the lower level system to the disk cache 13 of the upper level system prior to allowing CPU 11 to complete its upper level system operation of transferring the data block from the disk cache 13 to the user buffer 14 in the main memory 12. Thus, Kashima's CPU 11 does not operate as a lower level system as claimed by Applicants.

Examples of Applicants' claimed lower level system can be found in Applicants' original specification at paragraph 0050 where "Lower-level storage module 220 manages disk storage 230, in order to provide upper-level system 210 access to disk storage 230," and at paragraph 0051 where "Lower-level storage module 220 can be, for example, a volume manager or some other hardware or software module capable of managing disk storage 230."

In response to remark (b) on page 13 of the Final Office Action, Applicants respectfully submit that a definition for the claimed "cloning information" can be found at paragraph [0023] of Applicants' original specification. Specifically, when "an upper-level system (e.g., a

filesystem, a database application, a firmware module or the like) caches pages, those pages can be *cloned* into pages kept in a separate cache referred to herein as an old data cache”

(Applicants’ original specification, paragraph 0023, italics added for emphasis). Rather than merely copying, cloning a page refers to caching information in an old data cache where “the information in the cloned page can be used in situations in which that information would typically [need to] be read from a storage system” (Applicants’ original specification paragraph 0023). Cloned pages are preferred to copied pages because when cloned, an initial read operation from a storage device by the lower-level storage system to use the cloned information is avoided. For a more detailed explanation of cloning, Applicants’ refer the Examiner to paragraph 0063 of Applicants’ original specification.

[0063] Using a technique according to the present invention, whenever a filesystem dirties a page having valid contents (i.e., contents that are synchronized with the data stored in the storage system), the filesystem can clone the page, copying the existing contents into the new page before modifying the old page. The filesystem also signals the volume manager, indicating that the volume manager should read and cache the corresponding parity information (parity block(s)). The cloned page is then used by the volume manager in completing the other phases of the write operation being performed. Subsequent modifications to the paged data goes to the original page. When this dirty (original) page is flushed by the filesystem, resulting in a volume write, the volume manager can completely eliminate the read phase of the write operation, since the volume manager now has at its disposal the old data (in the cloned page) and old parity (in the cached parity blocks).

(Applicants’ original specification, page 15)

As stated on page 12 of Applicants’ January 13, 2006 response, the formative “cloning” was specifically selected by Applicants for the purpose of distinguishing the claimed cloning method from merely copying information. Cloning refers to more than simply copying

information from one place to another. Although cloning may comprise copying information as required by Applicants' dependent claim 3, cloning refers to preserving a version of data within a cache to avoid a read operation from a storage device to retrieve the required data. Thus, Applicants urge the Examiner to recognize the distinction between Applicants' claimed cloning operations and the common copying operations of Kashima.

Applicants' claim 36 was drafted to further delineate Applicants' invention from Kashima, and Applicants respectfully submit that Kashima fails to anticipate these limitations. In response to remarks (c) and (d) on page 13 of the Final Office Action, Applicants note that claim 36 specifically states that the "second cache comprises said second unit of storage." Applicants' respectfully submit that, despite being inapposite in either case, the Final Office Action remarks with respect to (c) and (d) are inconsistent because they equate Applicants' claimed second unit of storage with Kashima's disk array 1 rather than with Kashima's old data cache 17 as previously noted in the Final Office Action at page 3. Regardless, Kashima fails to show the cloning of the first cache into the second cache prior to modifying information in the first cache. The copying of information in Kashima does not appear to be affected by the modification of the information.

Although Kashima shows copying "data blocks on the disk cache 13 into the old data cache 17 of the main memory 12" and copying "data blocks of the user buffer 14 of the main memory 12 into the disk cache 13 to store as new data blocks therein" (Kashima, col. 5, lines 21-26), the copying of Kashima is obviously different than Applicants' claimed cloning and fails to anticipate Applicants' claimed cloning because neither of Kashima's first and second caches that are maintained by the upper-level system are accessed by a lower-level system. With respect to remark (e) of the Final Office Action, the Examiner inconsistently states that "Kashima's first

cache ... is accessed by a lower-level system,” the lower-level system being equated with the disk array 1 rather than CPU 11 as stated earlier in the Final Office Action with respect to Examiner remark (a) (see top of page 13 in the Final Office Action).

At most, the data held in the old data cache 17 of Kashima is sent to the disk array device 1 during a write operation (see Kashima, col. 5, lines 32-37). The disk array device 1 does not perform an access into (or cause such access to) the old data cache 17 of Kashima (see Kashima, col. 5, lines 34-37). In other words, using the claim associations delineated in the Final Office Action, Kashima clearly fails to teach, suggest, or otherwise disclose accessing a second cache by the lower level system when both the second and first caches are maintained by the upper level system.

In addition, Kashima fails to provide features comparable to the claimed cloning. The claimed cloning is performed prior to information in the first unit of storage being modified, the first unit of storage being maintained by one of an upper-level system and a lower-level system; the second unit of storage being accessed by the other of the upper-level system and the lower-level system.

In view of the above described distinctions as well as others, Applicants respectfully request the Examiner to withdraw the 35 U.S.C. § 102(e) rejection of independent claims 14, 27, 30, 33, and 36 as being anticipated by Kashima. As dependent claims 3-13, 15-26, 28-29, 31-32, and 34-35 add limitations to otherwise allowable base claims, Applicants also urge the Examiner to withdraw the 35 U.S.C. § 102(e) rejection to these claims.

Regarding other of Applicants’ claim limitations, as generally recited in Applicants independent claims 27, 30, 33, and 36, Applicants’ independent claim 14 recites the following:

A storage system comprising:
an old data cache, wherein said old data cache is configured to be
maintained by one of an upper-level system and a lower-level
system, and accessed by the other of said upper-level system and
said lower-level system.

In an attempt to demonstrate the limitations of Applicants' independent claim 14, in the first paragraph on page 6 of the February 15, 2006 Final Office Action, Kashima's old data cache 17 is equated with Applicants' claimed "old data cache." The same paragraph of the Final Office Action also states that the old data cache 17 is "configured to be maintained by an upper-level system." Again, the element corresponding to the upper-level system in Kashima is explicitly delineated as Kashima's "main memory 12." Assuming that the Final Office Action intended the final rejection to be consistent for both claims 14 and claim 36, Applicants' understand the Examiner to have intended the Final Office Action to then read that the "old data cache is accessed by the other of said upper-level system and said lower-level system." However, even if this interpretation is taken, old data cache 17 of Kashima does not provide features in any way comparable to the claimed limitations of Applicants' independent claim 14. Specifically, old data cache 17 of Kashima is not configured to be maintained by one of an upper-level system and a lower-level system, and accessed by the other of the upper-level system and the lower-level system.

Applicants' old data cache is defined in the specification to provide these features and independent claim 14 expressly includes the limitations. Conveniently, having one system maintain the old data cache and allowing the other system to access the old data cache, the need to read old data from another source is eliminated. Thus, Kashima does not anticipate Applicants' independent claim 14 because old data cache 17 of Kashima is not configured to be

maintained by one of an upper-level system and a lower-level system, and accessed by the other of the upper-level system and the lower-level system. In response to remark (a) on page 13 of the Final Office Action, the Examiner appears to have ignored the above reasoning and merely recited the language of Applicants' claim 14 interwoven with somewhat random references to Kashima.

Rejection of Claims under 35 U.S.C. § 103

Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kashima. Applicants respectfully traverse this rejection.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP 2142. The Applicants respectfully submit that the Examiner has failed to establish a prima facie case of obviousness.

In response to remarks (f) and (g) of the Final Office Action, Applicants respectfully submit that the limitations of independent claim 36 are part of the limitations to any claim dependent thereon. Thus, any prior art deficiencies with respect to claim 36 limitations are also

part of any claim dependent on claim 36. With respect to any 103 rejection of dependent claim 2, deficiencies of the prior art that are discovered by the Examiner must be overcome as well as any deficiencies of the prior art that are discovered by Applicants. Therefore, Applicants' reference to prior art deficiencies with respect to independent claim 36 are proper when discussing the 103 rejection of dependent claim 2.

Claim 2 depends from claim 1 which depends from independent claim 36. As discussed with respect to the above 102 rejection, the limitations of independent claim 36 are not found in Kashima, much less the further limitations added by dependent claim 1 and further added by the rejected dependent claim 2. In formulating the 103 rejection of the October 14, 2005 Office Action, the Examiner failed to address modifying Kashima in an attempt to support the cloning limitations required by dependent claim 2 through its independent base claim 36. Thus, no appropriate suggestion or motivation has been offered to modify Kashima as required to support a prima facie case of obviousness. Further, any modification to Kashima to show the cloning would not be based on Kashima's teachings or suggestion, but on Applicants' disclosure, which is improper hindsight.

Also not shown by Kashima is the dependent claim 2 feature apparent through claim 2's dependency on independent base claim 36 requiring the maintaining of a first cache and a second cache by one of an upper-level system and a lower-level system, and providing access to the second cache by the other of the upper-level system and the lower-level system, i.e., the first and second caches being accessible by both of the upper and lower level systems. Kashima does not teach these features of dependent claim 2 much less the single cache feature of dependent claim 2, and the features would not be obvious because the caching arrangement is irrelevant as to whether the upper-level system and the lower-level system access cloned information in a second

cache or a single cache holding the cloned information. In response to remark (h) of the Final Office Action, Applicants respectfully disagree with the Examiner that “a single cache comprising a plurality of caches” is admitted prior art, and Applicants hereby traverse the Examiner’s assertion of Official Notice concerning such prior art.

In response to remark (i) of the Final Office Action, a benefit realized by Applicants’ invention, not even contemplated by Kashima appears to be overlooked. Although, as elucidated by the Examiner in the Final Office Action, numerous benefits may arise from integrating multiple cache components on a single chip, the Kashima system is incapable of providing such benefits because Kashima must send all data to disk array 1, regardless of whether the data was initially from a single cache or multiple caches. Kashima does not teach or suggest the limitations of dependent claim 2 because there is no advantage for Kashima to modify their invention in the manner of the claimed invention. For example, as shown in the below cited portion of Kashima, whenever Kashima holds a copy of cached data, Kashima still needs to send the data (e.g., the new data 6, the old data 7, the old ck data 8) to the disk array 1 to generate new CK data 9 by performing an exclusive OR (XOR) at the XOR arithmetic unit 3.

... the OS moves to step S11 and transfers the new data block on the disk cache 13 and the old data blocks on the old data cache 17 to the disk array device 1 in step S11. Next, in step S12, the disk array device 1 executes an exclusive OR calculation in the exclusive OR arithmetic unit 3 by using the block of the transferred new data 6, the blocks of the old data 7 and the blocks of the old CK data 8 on the old CK data cache 16 to produce a block of the new CK data 9.

Kashima, col. 5, lines 34-42 (emphasis added)

Thus, having the old and new data in the same cache provides no benefit to Kashima since Kashima would still need to send the old and new data to disk array 1. In the claimed

invention, however, by keeping both old and new data in a single cache, the cloning operation is made easier and more efficient for reasons such as those stated by the Examiner in the Final Office Action. Kashima is oblivious to this advantage, as would be expected, given that Kashima specifically fails to teach these limitations of the claimed invention. Since Kashima would simply be sending this data out of the cache, whether one or two caches were used, Kashima's system would enjoy none of the advantages to using a single cache, and in fact, no reason for providing two such caches would exist in Kashima's system.

Thus, Applicants respectfully submit that dependent claim 2 is patentable in view of Kashima. For at least the above reasons, Applicants urge the Examiner to withdraw the 35 U.S.C. § 103(a) rejection of dependent claim 2.

CONCLUSION

In view of the amendments and remarks set forth herein, the application is believed to be in condition for allowance and a notice to that effect is solicited. Nonetheless, should any issues remain that might be subject to resolution through a telephonic interview, the Examiner is invited to telephone the undersigned at 512-439-5089.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Mail Stop AE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on April 17, 2006.


Attorney for Applicants

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Date of Signature

Respectfully submitted,



Russell C. Scott
Attorney for Applicants
Reg. No. 43,103
Telephone: (512) 439-5089
Facsimile: (512) 439-5099